Canon Envirothon Aquatics Study Guide

Key Point 1—Abiotic factors

National Science Standards Correlation

Learning Objectives:

1. Know the processes and phases for each part of the water cycle and understand the water cycle's role in soil nutrient erosion, salinization of agricultural lands, and climatic influences.
2. Understand the concept and components of a watershed and be able to identify stream orders and watershed boundaries. Know the features of a healthy watershed and an unhealthy watershed.
3. Know how to perform and interpret chemical water quality tests and understand why aquatic organisms and water quality is affected by the physical, chemical and biological conditions of the water.

Suggested Activities:

1. Use topographic maps to investigate the concept of a watershed, identify a river's watershed system, and delineate the watershed of a given area. Be able to describe how different land uses and watershed characteristics can affect water runoff, water flow, types of stream habitats and management approaches.
2. Investigate and find out who is using the water in your watershed and become familiar with historic stream and river levels to learn if levels are increasing or decreasing. Use stream assessment data to determine the health of your watershed.
3. Conduct chemical water quality tests to determine the temperature, dissolved oxygen, pH, phosphorus, alkalinity, nitrogen, and dissolved oxygen percent saturation of a water sample and explain why these test results are indicators of water quality and can be used to assess and manage aquatic environments.

Resources:

1. USGS Water Science Basics: What is the Water Cycle?
2. Basic concepts on Watersheds
3. How to Read a Topographic Map and Delineate a Watershed
4. Georgia Adopt a Stream Manual on Biological and Chemical Stream Monitoring

Key Point 2—Biotic factors

Learning Objectives:

1. Understand the dependence of all organisms on one another and how energy and matter flow within an aquatic ecosystem.
2. Understand the concept of carrying capacity for a given aquatic ecosystem, and be able to discuss how competing water usage may affect the ability of the system to sustain wildlife, forestry and anthropogenic needs.
3. Identify common, rare, threatened and endangered aquatic species as well as Aquatic Nuisance Species (ANS) through the use of a key.
4. Know how to perform biological water quality monitoring tests and understand why these tests are used to assess and manage aquatic environments.

Suggested Activities:

1. Describe the habitat needs of three specific aquatic animals, and compare and contrast the flow of energy in three different aquatic food chains.
2. Create a visual display of rare and endangered aquatic species. Explain how human activities are causing species imperilment and specify actions being taken to protect these species.
3. Conduct a biological stream assessment by collecting macro-invertebrates. Stream Data sheets (key point 1, resource 4) should be used to record and analyze information. Explain why these organisms are biological indicators that help us determine the health of a stream or waterway.

Resources:

1. Introduction to Watershed Ecology: Watershed Academy Web
2. NOAA The Endangered Species Act: Marine Species
3. EPA An Introduction to Freshwater Fishes as Biological Indicators, pages 3-12
4. Georgia Adopt a Stream Manual on Biological and Chemical Stream Monitoring
5. WV Save Our Streams' Benthic Macro-invertebrate field guide

Key Point 3—Aquatic Environments

Learning Objectives:

1. Identify aquatic and wetland environments based on their physical, chemical and biological characteristics.
2. Know characteristics of different types of aquifers, and understand historical trends and threats to groundwater quantity and quality.
3. Understand societal benefits and ecological functions of wetlands.
4. Understand the functions and values of riparian zones and be able to identify riparian zone areas.

Suggested Activities:

1. Describe the physical, chemical and biological characteristics of a stream, river, pond, lake and wetland.
2. Explain how different types of aquifers are indicators of water quantity and water quality. Describe how subsidence and salt water intrusion are related to the falling water table in many aquifers.
3. Describe three functions of wetlands, and explain how these functions are met in the absence of wetlands.
4. Describe three functions of riparian zones and explain how the removal of or damage to the riparian zone would affect water quality and specific aquatic food chains.

Resources:

1. USGS Ground water
2. Types of Wetlands
3. Wetland Functions and Values
4. Benefits of Riparian Zones
5. Riparian Zones: Managing Early-Successional Habitats near the Water's Edge

Key Point 4—Water Protection and Conservation

Learning Objectives:

1. Understand how education programs and enforcement agencies are working together to protect aquatic habitats and preventing those who use our waterways from inadvertently transporting Aquatic Nuisance Species ANS from one river to another.
2. Interpret major provincial and /or federal laws and methods used to protect water quality (i.e. surface and ground water). Utilize this information to propose management decisions that would improve the quality of water in a given situation.
3. Be familiar with the Federal, Provincial and state agencies that provide oversight of water resources, and understand that Geographic Information Systems (GIS) is a useful and important tool in the management of water resources.
4. Identify global and local sources of point and non-point source pollution and be able to discuss methods to reduce point and non-point source pollution.
5. Understand the interaction of competing uses of water for water supply, hydropower, navigation, wildlife, recreation, waste assimilation, irrigation, and industry.
6. Know the meaning of water conservation, and understand why it is important every time you turn on a faucet.

Suggested Activities:

1. List at least 3 Aquatic Nuisance Species ANS, and describe their effects on an aquatic ecosystem. Consider what can happen when predator ANS are imported, and develop a plan for the eradication of a target ANS.
2. Site water protection laws at a mock hearing to decide whether a permit should be given to build a new shopping mall along a river.
3. Explain how Geographic Information Systems (GIS) are being used to help communities assess water quality and watershed health information.
4. Compare water usage in different regions of Canada and the United States and propose actions to help countries strike a balance between supply and demand in order to realize maximum benefit from our water resources.
5. Design a comprehensive water conservation plan for your home and the watershed below your home. This should include groundwater replenishment, securing sediment on your property, managing non-point source pollution and following the path of good quality water as it leaves your property on its way to the sea.
6. Many dams are used to provide low cost electricity at the critical time of day when there is peak demand for electricity. Today a major issue is deciding which is more important to the economy, low cost energy or improving/restoring the ecology of a

river. Evaluate the issue and develop recommendations for conservation groups and utility executives.

Resources:

1. What are Aquatic Nuisance Species (ANS)?
2. ANS Task Force
3. Conservation of Great Lakes Wetlands: Environment Canada
4. Summary of the Federal Clean Water Act: (SDWA)
5. The Quality of Our Nation's Water
6. GIS and Hydrology
7. Water Resources
8. Water Conservation
9. Polluted Runoff: Nonpoint Source Pollution